CHAPTER 16

MANAGING NETWORK DESIGN AND IMPLEMENTATION

After reading this chapter and completing the exercises, you will be able to:

- Describe the elements and benefits of project management
- Analyze the current status of a network
- Perform a needs assessment and recommend changes based on your findings
- Manage a network implementation project
- Design and test a pilot network

ON THE JOB

I'm a network manager at a packaging company. A year ago we decided to change our network from Token Ring to Ethernet (partly because Token Ring devices are so much more expensive than their Ethernet counterparts). That project began a year ago and it's still going on. We ran into numerous obstacles that we just didn't expect.

One significant problem was staffing the project. Many of my staff are highly skilled engineers who are happy designing networks but aren't enthused about installing new NICs in PCs. We found some temporary staff to help us, but then we spent a lot of time training the staff. The time spent training them caused our project timelines to slip.

Another problem was explaining the change to the rest of our company, who didn't know what Token Ring or Ethernet meant. They only knew that we would be taking down the network and taking over their machines from time to time. Halfway into the project we decided to hold user meetings, in which we would describe the changes and their consequences and field questions from users. These meetings helped users understand what was going on and bolstered our staff's reputation.

While we couldn't have foreseen everything, better planning would have made this project easier and maybe less costly from the start. For my next large project, I'm hiring a professional project manager to help.

Joe Witkowski
M-Star Industries

In preceding chapters, you learned about the various elements that make up networks. In this chapter, you will learn how to put those elements together to improve an existing network or plan a network from start to finish. One of the first steps in implementing a network is devising a plan. Before you can create such a plan, however, you must learn some project management fundamentals. Project management is a broad term that refers to the process of managing timelines, resources, budgets, and personnel so as to reach a specific goal. Each of us regularly embarks on projects—whether the project involves writing a term paper or fixing a car's engine. Rarely do we devise project plans for our own projects. For projects that affect

many people, require significant capital outlay, or influence a company's profitability, project management is essential to ensure the project's success. This chapter will discuss not only project management, but also techniques for approaching typical network implementation projects.

Introduction to Project Management

Project Management is the practice of managing resources, staff, budget, timelines, and other variables so as to achieve a specific goal within given bounds. For example, if you were a Web site development consultant, you might use project management techniques to establish an online store for a national furniture retailer. The project might be constrained by time (for example, you might aim to establish the e-commerce site before November 1 so as to cater to holiday shoppers), money, or the number of developers who can help you with the project. In the networking field, you might employ the basic principles of project management in the process of replacing the CAT3 wiring in your organization's building with CAT5e wiring.

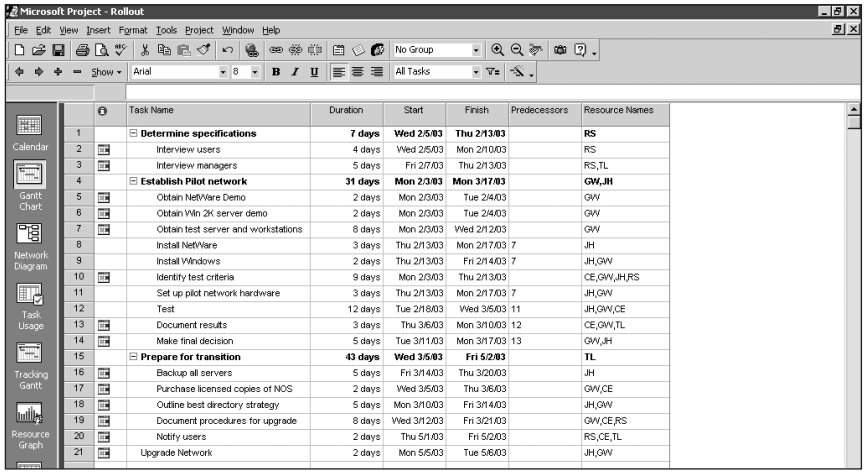
Every project begins with identifying a need (although, of course, identifying a need may not result in a project). As you will learn later in this chapter, you can conduct a feasibility study to determine whether a particular need warrants a full-fledged project. If the feasibility study confirms that a project is necessary, you must appoint a project manager and begin planning the project. As discussed in the following section, the project manager's first step is to conduct a needs assessment and establish the project goals. Only then can the project manager create a project plan.

The other elements of a full-scale project include participants, funding, a specific means of communication, definitive processes, contingency plans, and a testing and evaluation phase. The following sections describe these elements in more detail.

The Web offers many valuable resources for project managers. A good place to start is at the Project Management Institute's Web site for project managers at www.pmi.org.

The Project Plan

A **project plan** is the way in which details of a managed project (for example, the timeline and the significant tasks) are organized. Plans for small projects may take the form of a simple text or spreadsheet document (in fact, they may begin as notes scribbled on a piece of paper). For larger projects, however, you will typically take advantage of project management software (such as Microsoft Project, PlanView, or PrimaVera Project Planner). Project management software facilitates project planning by providing a framework for inputting tasks, timelines, resource assignments, completion dates, and so on. Such software is also highly customizable, so you can use only a small portion or all of its features, depending on the scope of your project and your project management skills. Figure 16-1 shows a list of tasks as they might appear in Microsoft Project.



	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	**Determine specifications**	**7 days**	**Wed 2/5/03**	**Thu 2/13/03**		**RS**
2	Interview users	4 days	Wed 2/5/03	Mon 2/10/03		RS
3	Interview managers	5 days	Fri 2/7/03	Thu 2/13/03		RS,TL
4	**Establish Pilot network**	**31 days**	**Mon 2/3/03**	**Mon 3/17/03**		**GW,JH**
5	Obtain NetWare Demo	2 days	Mon 2/3/03	Tue 2/4/03		GW
6	Obtain Win 2K server demo	2 days	Mon 2/3/03	Tue 2/4/03		GW
7	Obtain test server and workstations	8 days	Mon 2/3/03	Wed 2/12/03		GW
8	Install NetWare	3 days	Thu 2/13/03	Mon 2/17/03	7	JH
9	Install Windows	2 days	Thu 2/13/03	Fri 2/14/03	7	JH,GW
10	Identify test criteria	9 days	Mon 2/3/03	Thu 2/13/03		CE,GW,JH,RS
11	Set up pilot network hardware	3 days	Thu 2/13/03	Mon 2/17/03	7	JH,GW
12	Test	12 days	Tue 2/18/03	Wed 3/5/03	11	JH,GW,CE
13	Document results	3 days	Thu 3/6/03	Mon 3/10/03	12	CE,GW,TL
14	Make final decision	5 days	Tue 3/11/03	Mon 3/17/03	13	GW,JH
15	**Prepare for transition**	**43 days**	**Wed 3/5/03**	**Fri 5/2/03**		**TL**
16	Backup all servers	5 days	Fri 3/14/03	Thu 3/20/03		JH
17	Purchase licensed copies of NOS	2 days	Wed 3/5/03	Thu 3/6/03		GW,CE
18	Outline best directory strategy	5 days	Mon 3/10/03	Fri 3/14/03		JH,GW
19	Document procedures for upgrade	8 days	Wed 3/12/03	Fri 3/21/03		GW,CE,RS
20	Notify users	2 days	Thu 5/1/03	Fri 5/2/03		RS,CE,TL
21	Upgrade Network	2 days	Mon 5/5/03	Tue 5/6/03		JH,GW

Figure 16-1 View of a project in Microsoft Project

No matter how large or small the project, its project plan will contain some common elements, as described below:

- *Task breakdown*—A project should be divided into specific tasks. Larger tasks are then broken into even smaller subtasks. For example, establishing an e-commerce Web site and server at an Internet service provider's data center represents a large task with numerous subtasks: obtaining racks for the equipment, ensuring backup and bandwidth capacity, obtaining software and hardware, installing equipment and software, configuring the hardware, testing the software, and so on.

You may find it tricky to separate a project into meaningful, discrete tasks that are specific enough to measure progress and guide participants, but not so narrow that they lose meaning. As you gain project planning experience, you will better be able to gauge how to best separate tasks into smaller but significant subtasks.

- *Dependencies*—The project plan specifies which tasks depend on the completion of previous tasks before you can begin them. In some project management software, the tasks that must be completed before other tasks can begin are called **predecessors**. In the example of establishing an e-commerce server, you would have to determine which type of server you want to purchase before ordering the equipment racks. This ordering of tasks is necessary because racks come in different widths and depths. Thus the task of determining the type of server needed is a predecessor of the task of obtaining the racks. It's critical to examine potential dependencies in a project plan, because a dependency means that part of the project depends on another part. If you neglect to consider a dependency

at the beginning of a project, stopping to address it during the project may delay the schedule and impose unnecessary stress on team members, who must later rush to complete their tasks. Careful planning will reveal any dependencies that might affect the project's timeline and success.

- *Timeline*—The project plan should identify how long each task will take (with start and finish dates), which tasks take priority (due to dependencies), and how the timeline might change depending on resource availability or dependencies. Timelines are not always easy to predict. Seasoned professionals may be able to gauge how long a particular task might take based on their previous experience with similar tasks. Every project may entail conditions that affect a timeline differently, however. When creating a timeline, you should allow extra time for any especially significant tasks. For instance, in the e-commerce server example, the manufacturer might tell you that obtaining the equipment racks will take one week. If you plan for delivery in a week, and the installation of the Web site depends on this task, your entire project will be delayed if the racks don't arrive for two weeks. A **Gantt chart** is a popular method for depicting when projects begin and end along a horizontal timeline. Figure 16-2 illustrates a simple Gantt chart.

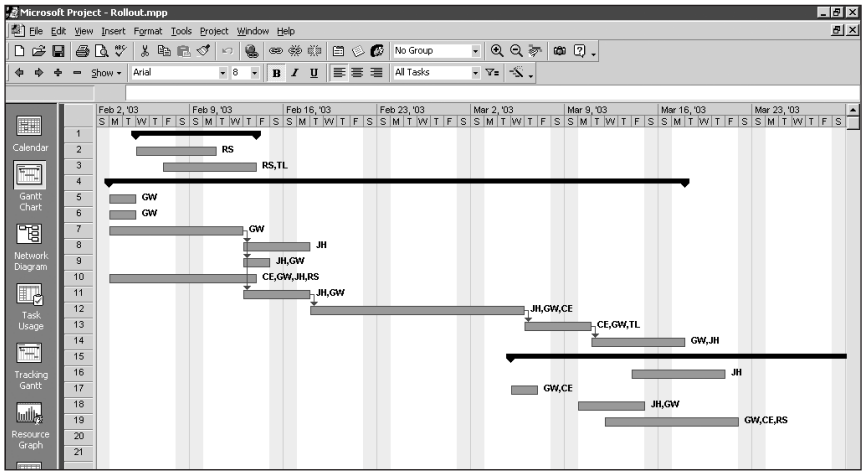


Figure 16-2 A simple Gantt chart

You may be asked to plan a project with seemingly impossible deadlines. One technique for making the project fit into a tight time frame is to work backward to create the timeline. In other words, begin at the project's predetermined endpoint and move toward the beginning of the project, allowing the normal time requirements for tasks. This method will highlight which tasks may delay the project and therefore need to be dropped or modified, at least temporarily.

- *Resources*—All projects require the staffing, materials, and money that are collectively known as **resources**. A project plan can specify all resources needed for each task or group of tasks. At the very least, it should identify who is responsible for tasks, whether it is a committee, consultant, manager, or technical person. This person is the **owner** of the task. The owner does not necessarily have to perform the work himself or herself, but nevertheless must ensure that it is completed on time and within budgetary guidelines.
- *Milestones*—Every project has significant accomplishments that mark specific steps in their progress. In project planning, a **milestone** is a reference point that marks the completion of a major task or group of tasks in the project and contributes to measuring the project's progress. For example, if you were in charge of the e-commerce server project, you might designate the completion of the software installation on your server as being a milestone. Milestones are particularly useful in large projects that have high visibility within the organization. They provide a quick indication of a project's relative success or failure.

In addition to these elements, project plans may provide information on task priority, the amount of flexibility in the timeline, task successors, links to other project plans, and so on. With most project planning software, you can add your own columns to the plan and insert any type of information you deem appropriate. For example, if you are managing a very large network design project, you might create a Web site with links to documentation for each phase of the project. In the project plan, you might include a column to list the URLs of the documents for each task or group of tasks.

During the course of a project, the project plan will likely undergo several changes. Some changes may result from unforeseen circumstances; others may reflect milestone evaluations and adjustments. Later in this section, you will learn more about these contingencies and how to plan for them.

Project Participants

As mentioned previously, each project depends on many resources. The human resources involved in a project may be employees from your department or other departments within the organization, outside consultants, vendor representatives, or employees from other organizations. Usually, human resources from various factions work together in teams. Although a single person may handle some project tasks (such as ordering a server,

updating a document, or configuring a router), larger tasks should be accomplished by teams. For example, as the project manager for a network redesign, you might assign the task of determining how to upgrade the backbone to a team consisting of a cabling vendor, a network technician, a facilities architect, and an IT manager. In an organization with limited staff members, some project participants may belong to more than one team.

As a project manager, you probably won't supervise everyone involved in the project. Therefore, you need managers who agree with the project's goals and will strive to help you achieve them. These authority figures are called project **sponsors**. Although sponsors rarely participate in project tasks and do not necessarily supervise the project manager, they can lobby for budget increases necessary to complete the project, appeal to a group of managers to extend a project's deadline, assist with negotiating vendor contracts, and so on.

A sponsor may be the person who originated the idea for the project. For example, suppose users in your organization complain about slow network response time, particularly when they try to pick up their e-mail. As a network administrator, you respond to these complaints by finding out the source of the poor network performance. You determine that the problem lies in the fact that the network uses routers and a 10-Mbps transmission rate. To solve the problem, you would like to upgrade the network to be fully switched and to run at 100-Mbps. You write a proposal for the change and bring it to the director of IT. She agrees with your research and your proposal, so she offers to become the project's sponsor. She will take your proposal to your company's executive board and attempt to obtain approval for the resources necessary to complete the project.

Another important group of project participants comprises the stakeholders. A **stakeholder** is any person who may be affected by the project, for better or for worse. In the example of upgrading a network to a fully switched, 100-Mbps environment, the stakeholders will include users (who will benefit from faster network access), executives (not only because they are network users, but also because they have responsibility for the budget), IT managers (who will ultimately determine the success or failure of the project), and project team members. Typically, the stakeholders are the people to whom the project teams must answer. At the beginning of a project, it is wise to communicate the project's goals, timelines, affects, and contingencies to project stakeholders. As you'll learn in the next section, it is also advisable to maintain regular communication with stakeholders about the project's progress.

Funding

Every project—whether it entails a simple hardware upgrade or an entire network redesign—requires funding. A project budget is usually set at the beginning of a project and approved by a hierarchy of managers whose staff participate in the project. Of course, a project's budget will depend on its breadth and complexity. As a project manager, you may have little control over the project's budget after it is established. For this reason, you should estimate your costs generously in the initial proposal for the project. It is always preferable to complete a project under budget than to continually appeal for more funding.

In some cases, the amount of funding available to your project can help to make other resources available. Naturally, if managers allocated $200,000 to your project rather than $20,000, you will have 10 times more money to spend on staffing, tools that might make your teams more efficient, or state-of-the-art hardware and software. Sometimes, however, no matter how much funding is available to your project, other constraints may block your progress. For example, your project of upgrading the company's customer service database may depend on the highly specialized knowledge of just two programmers who originally developed the system. Even a budget allocation of $2,000,000 for contractors or new staff wouldn't help you obtain qualified staff, because only these two programmers truly understand how the application works. In addition, the software they're creating might be constrained by functional limits on how many people can change the code at any given time. Thus your project is forced to rely on the efficiency of those two programmers.

Communications

Even if a project has sufficient funding, technical staff, and support from sponsors, it will falter if communication methods are not well defined and carefully followed. Communications are critical for several purposes:

- To ensure that a project's goals are understood by participants, stakeholders, and sponsors
- To keep a project's timeline and budget on track
- To encourage teamwork among participants
- To allow you to learn from previous mistakes
- To prevent fingerpointing if a task is not completed correctly or on time
- To avoid duplication of efforts
- To prepare stakeholders for the effects of the change

At the beginning of a project, the project manager should take responsibility for establishing the methods of communication. Suggested methods include weekly status meetings, daily status briefings for each team, weekly messages to stakeholders about the project's progress, monthly reports that compare a project's *anticipated* spending and timeline with its *actual* spending and timeline, distribution lists for each project team to share e-mail correspondence, and a Web page containing an archive of meeting minutes and other important documents pertaining to the project. Be creative—you might find other effective ways to communicate within your team. Whatever methods you choose, keep in mind that carefully fostered teamwork will contribute to the success of your project.

Processes

In almost everything you do, you follow a process: buying groceries, reading a book, building a deck. When you perform these tasks alone, you can do them whichever way you prefer. When a team of individuals must perform tasks together, however, agreeing on a process beforehand will help to ensure that the task is completed efficiently and that the team's efforts result in a desirable, high-quality outcome.

Process management consists of planning for and handling the steps needed to accomplish a goal in a systematic way. The processes you might manage during a project's implementation include change, support, training, transitioning, delegation, and problem resolution. If you've never managed processes before, it may be difficult to envision this endeavor without concrete examples. Consider how process management can help in the following scenarios:

- You and your colleagues decide to upgrade the network operating system on one of your file servers. You are responsible for ensuring that the change works correctly. Before performing the upgrade, you may want to define a change process. The change process could include notifying potentially affected users at least five business days before you make the modification, documenting exactly what the change will involve and who will make it, backing up the server prior to making the change, and providing a plan for reversing the operation should it cause problems on the server.
- A new network administrator is hired to shoulder some of the responsibilities previously assigned to an existing network administrator. The current network administrator plans to go on a two-week vacation on a remote island only seven days after the new network administrator starts. Before the new employee arrives, you may want to establish a training process. Part of this process could include asking the existing network administrator to identify recently completed tasks, outlining a training plan for the new employee, and identifying other employees who can act as resources for the new employee in different subject areas.
- You manage the 7 days a week, 24 hours a day support team for a corporate LAN. If serious problems arise during the night or on weekends, you may need to help with problem resolution. Having a problem management process in place will make your job and the jobs of the support analysts easier. Part of your problem management process may include notification of all affected customers if the problem hasn't been resolved within 30 minutes, maintenance of a list of second-level support contacts, instructions for how to record the problem in a call-tracking system, and procedures for contacting vendors required to troubleshoot hardware or software.

For any endeavor that requires the cooperation of several team members, process management is a wise investment of time. Creating a process will not be sufficient, however, unless everyone understands the process. You must ensure that the process is communicated to all

participants. Begin by proposing the need for a process at a meeting and ask for participants' input. After drafting the process, distribute it as a memo or post it on a Web page where everyone can find it. During the course of a project, urge colleagues to follow the agreed-upon processes.

Processes help you manage unusual or troublesome situations. In the next section, you will learn about another element of project management that can guide participants when things go seriously awry.

Contingency Planning

Even the most meticulously planned project may be derailed by unforeseen circumstances. For instance, a key team participant may quit, your budget may be unexpectedly cut, or a software package may not work as promised. Each of these conditions may threaten to delay your project's completion. To prepare for such circumstances, you must create a contingency plan at the beginning of the project. **Contingency planning** is the process of identifying steps that will minimize the risk of unforeseen events that endanger the quality or timeliness of the project's goals.

Although you cannot predict all possible pitfalls in a project, you should at least plan for the most likely hazards. To identify potential threats to the success of your project, you should analyze your organization's history. For instance, you may work for a company that is notorious for taking team participants who have committed to one project and switching them to new projects. In that case, you may want to increase the number of people working on the project initially, so that losing one or two participants will not detrimentally affect your project's success. Alternately, you may want to budget for subcontractors to step in when or if your organization's staff members become unavailable. In another organization, you may have experience with programmers who chronically underestimate the time needed to customize programs for your users. In this case, you should add time to the customization tasks to plan for the possibility that the programming will take longer than the programmers suggest.

In a networking project, taking some of the following measures in the beginning can prevent you from having to scramble during the project's implementation:

- Order more hardware components than you think you need.
- Ensure that your hardware and software vendors have extra components on hand and that they will respond to your requests.
- Document each piece of hardware and software that you order for the project. Also, keep a tally of supplies as they are received.
- Rely on a pilot network to test your project's goals (for example, to determine whether choosing switches over routers will improve your network's performance), in addition to testing the hardware and software components (for example, each switch that you purchase) that you will use.

- If the technology required to implement the project is new to project participants, ask a local consulting company with expertise in that technology to be available for questions in case you need help.

The amount of preparation you perform for each contingency should be commensurate with the potential effects of that possibility. For example, if you were planning a demonstration of your application to a very high-profile client who was considering purchasing the application for $5,000,000, you would want to plan a backup for everything that could possibly go wrong with your presentation. On the other hand, if you were planning a demonstration of the same program to your colleagues, you may not spend much time wondering what to do in case the splash screen containing your company logo doesn't appear.

Another way to help ensure your project's success is to perform regular testing and evaluation, as discussed in the following section.

Testing and Evaluation

Once you have reached a project milestone, you will want to verify that you are on the right path. One way of accomplishing this goal is through testing. For instance, if you were managing a project to upgrade a building's LAN from 10 Mbps to 100 Mbps, you might want to tackle one small segment of the network first. Before moving to the next segment, you should ensure that all workstation and switch or router configurations on the first segment work correctly. By confirming this fact, you can potentially prevent future down time or troubleshooting.

To successfully test your implementation, you must establish a testing plan that includes relevant methods and criteria. For example, your method of testing the network performance may be to use the Windows 2000 Server Network Monitor program from a server. For each performance test you perform, you will want to replicate this arrangement, so that you can compare your results across the various tests. In this case, the criteria you use to measure network performance may be the number of bytes that travel from one particular workstation to the server every five minutes.

Once you have devised a testing plan, emphasize to all project participants how vital it is to adhere to the plan. If participants ignore the testing plan for a backbone upgrade, for example, they might be tempted to quickly set up a workstation on a new network segment and assume that if they reach the network login prompt, the change is a success. Unfortunately, this approach may overlook protocol or transmission speed issues that can cause problems later. To provide an accurate assessment, a test plan should address at least the following questions:

- Was the change nominally successful? (For example, if the change comprised a backbone upgrade, can a client on the new backbone connect to the server?)
- Did the change fully accomplish its purpose? (For example, if the change comprised a backbone upgrade, did it result in a performance improvement?)
- If the change did not fully accomplish its purpose, did it partially accomplish its goal?

- Did the change result in unexpected consequences?
- Did the change point to a need for additional changes? (For example, if the change comprised a backbone upgrade, did testing reveal that new cabling was required for a segment whose cabling was initially thought to be adequate?)

For testing to be useful, project participants should clearly define the change's purpose before testing commences. For example, network technicians may suggest that a backbone upgrade will result in at least a 25% increase in performance for users on their company's WAN. This figure should be based on technical calculations of expected performance increases (rather than assumptions).

Accurately measuring such increases in performance depends on keeping a baseline of the network's performance before the change occurred. Performance baselines will aggregate network response data from different times of day and different places on the network. After the change is instituted, performance measurement should likewise be conducted at different nodes on the WAN and at different times of day (preferably using a network management software package). The testing team should then compare the new measurements to the baseline to determine whether the change accomplished its goal of increasing network performance by at least 25%.

In addition to developing test criteria, testing large-scale changes will require defining a test period, testing methods, and evaluation methods. In some cases, the testing may be straightforward. For example, if you installed a database software package on the server, you might ask users to attempt to log on and perform a simple query one afternoon to verify that the software works correctly. If all users perform their tasks successfully, then you can assume that the change was successful. Otherwise, you should consider the installation unsuccessful.

In other cases, test results may be more subjective. For example, you may have upgraded a database software package to improve the security of the database. In this case, testing may involve asking skilled security engineers or programmers to attempt to break into the database after implementation of the change. If they quickly break into the entire database, your testing reveals that the change was unsuccessful. If it takes a week for them to obtain only insignificant database information, however, your testing may reveal that the change worked as planned.

No matter whether your testing will be straightforward or subjective, the project manager should assign a leader to take charge of the testing team. This team leader will develop testing criteria, recruit testing volunteers, identify ways of gathering test data, compile test data, and, based on the testing results, pass conclusions to the project manager about the success of the change.

In addition to testing the project's changes and processes, you should test every piece of equipment required by the project as soon as it arrives. By verifying basic hardware functionality immediately, you will avoid later project delays caused by faulty components.

Now that you have been introduced to project management techniques, you are ready to learn about aspects of project management of particular interest to networking professionals.

Managing Network Implementation

Although numerous professions perform project management, information technology presents some unique challenges to successfully deploying changes. For example, although a caterer has to consider issues such as the number of dinner guests and the timing of the main meal, a network administrator needs to consider much more complicated issues, such as the compatibility of protocols and connectivity devices. In the previous section, you learned about project management elements that apply to any project. This section describes some project management techniques that apply specifically to network and other technology implementations.

Implementation Steps

This section presents a list of typical steps involved in implementing a network change after stakeholders and participants have identified some kind of unmet need. This outline is meant to be a guide to planning, not an actual project plan. You may find that not every step applies to your network or situation. In that case, you can move to the next step or modify the step to be more appropriate. The most significant steps in this process are described in more detail in the following sections.

1. Determine whether the proposed change is feasible, given your time, resource, and budgetary constraints. Compare proposed costs to proposed benefits.
2. If a change is deemed feasible and desirable, identify specific goals for a project. Break larger, vague goals into smaller, concrete goals.
3. Assess the current state of the network, including physical and logical topology, protocols, applications, operating systems, and number, type, and location of devices. Keep this documentation in a centrally accessible location.
4. Assess the requirements as expressed by stakeholders, including users, technical staff, and managers.
5. Create a project plan that includes tasks and subtasks, dependencies, resource allocation, timelines, and milestones. Specify necessary hardware and software purchases, in addition to desired contributions from contractors or vendors.
6. If possible, build a pilot network—a small-scale replica of your changed network—based on your recommendations. Define testing criteria for the small-scale network and evaluate your results against your needs.

7. If the pilot network shows promise, begin to implement the changes on a larger scale. At this stage, you may have to purchase hardware or software, coordinate with vendors, install or remove wiring, hardware, or software, or reconfigure hardware or software. Before you begin, make sure that you have all of the necessary tools and components.
8. If possible (if the changes are not on a global scale and can be effected in stages), release the changes to a hand-picked group of users who will evaluate the success of your network changes, using predefined criteria.
9. If the evaluation indicates that the changes were successful, release the changes to all users.
10. Update your network baseline documentation to reflect the changes.

Determining Project Feasibility

The first decision to make about any proposed project is whether spending time and resources on this project makes sense—that is, whether it's feasible. Often, and especially in technology-based companies, staff become so enamored with gadgetry and the desire for faster network access that they are willing to push a project through without realistically assessing its costs and benefits. For example, a network manager may attend a week-long conference on IP telephony, then return and announce to his staff that they should replace the entire phone system with a voice-over-data system. This project may be completed, despite the fact that the existing phone system works perfectly well, and despite the fact that spending money on a voice-over-data scheme may be less of a priority than purchasing redundant file servers.

To formalize the process of determining whether a proposed project makes sense, you can conduct a feasibility study. A **feasibility study** outlines the costs and benefits of the project and attempts to predict whether it will result in a favorable outcome (for example, whether it will achieve its goals without imposing excessive cost or time requirements on the organization). You can think of a feasibility study as a "pre-project plan." A feasibility study should be performed for any large-scale project before resources are committed to that project.

Often, organizations hire business consultants to help them develop a feasibility study. The advantage to outsourcing this work is that consultants will not make the same assumptions that internal staff might make when weighing the costs and benefits of a proposed project.

Setting Project Goals

Once a project is deemed feasible, you and the project team should define the project's goals. One technique for setting project goals is to begin with a broad goal, then narrow it down into specific goals that will contribute to the larger goal. For example, if your organization's board of directors has accepted a consultant's recommendation to

redesign your WAN so as to improve communications between offices and enable better Internet access, these two goals may equate to the overarching project goals. Beneath those goals, you may insert several smaller goals, such as partnering with a nationwide ISP, increasing WAN performance by 40% between the Chicago and San Diego offices, building an infrastructure that will enable growth into the East Asian market, and so on.

In addition to being specific, project goals should be attainable. The feasibility study should help determine whether you can achieve the project goals within the given time, budgetary, and resource constraints. If project goals are not attainable from the outset, you risk losing backing from both project sponsors and participants. And if you lose backing, chances are good that the project will fail.

Projects without clear goals will suffer from inefficiencies. A lack of well-defined goals can result in misunderstandings between project participants, sponsors, and stakeholders; lack of focus among team members; lack of proper resource allocation; and an uncertainty about whether the project's outcomes constituted success. Before developing the project plan, work with project participants and sponsors to clearly define the project's goals.

Baselining

In Chapter 13, you learned that baselining is the practice of measuring and recording a network's current state of operation. As described in that chapter, baselining includes keeping a history of performance measurements, such as response times and number of collisions. It also involves tracking the physical topology, logical topology, number of devices on the network, operating systems and protocols in use, and number and type of applications in use. In other words, this effort provides a complete picture of the network's current state. Baselining is critical to network implementations because it provides the basis not only for determining which changes may improve the network, but also for later evaluating how successful those improvements were.

The following list details the questions you need to answer as part of a baseline assessment. Bear in mind that your network may use several types of topologies, operating systems, devices, transmission speeds, applications, and so on.

- *Physical topology*—Which types of LAN and WAN topologies does your network use: bus, star, ring, hybrid, mesh, or a combination of these? Which type of backbone does your network use—collapsed, distributed, parallel, serial, or a combination of these? Which type and grade of cabling does your network use?
- *Logical topology*—Which transmission method does your network use—Ethernet or Token Ring? What transmission speed does it provide? Which switching methods does it apply?
- *Protocols*—Which protocols are used by servers, nodes, and connectivity devices?

- *Devices*—How many of the following devices are connected to your network—switches, routers, hubs, gateways, firewalls, servers, UPSs, printers, backup devices, and clients? Where are they (physically) located? What are their model numbers and vendors?
- *Operating systems*—Which network and desktop operating systems appear on the network? Which versions of these operating systems are used by each device? Which type and version of operating systems are used by connectivity devices such as routers?
- *Applications*—Which applications are used by clients and servers? Where do you store the applications? From where do they run?

If you have not already collected and centrally stored this information, it may take the efforts of several people and several weeks to compile it, depending on the size and complexity of your network. This evaluation will involve visits to the telecommunications and equipment rooms, an examination of servers and desktops, a review of receipts for software and hardware purchases, and potentially use of a sniffer or network monitoring software package. A baseline assessment may take a great deal of time and effort to complete, but it promises to save work in the future. Once you have compiled the information, organize it into a format (such as a database) that can be easily updated, allowing your staff to keep the baseline current.

Assessing Needs and Requirements

Everyone in your department might agree that your current e-mail system is too slow and needs to be replaced, or numerous users might complain that the connection between their office and the headquarters' LAN is unreliable. Often a network change project begins with a group of people (or one person in a position of authority) identifying a need. Before you concur with popular opinion about what must be changed and how the change must occur, as a responsible network administrator you should perform a thorough, objective needs assessment. A **needs assessment** is the process of clarifying the reasons and objectives underlying a proposed change. It involves interviewing users and other stakeholders and comparing perceptions to factual data. It may also involve analyzing network baseline data. Your goal in performing a needs assessment is to decide whether the change is worthwhile and necessary; you should also determine the appropriate scope and nature of the change.

A needs assessment may address the following questions:

- Is the expressed need valid, or does it mask a different need?
- Can the need be resolved?
- Is the need important enough to allocate resources to its resolution?
- If fulfilled, will the need result in additional needs? Will fulfilling the need satisfy other needs?

- Do users affected by the need agree that change is a good answer? What kind of resolution will satisfy them?

In the following sections, you will learn how to investigate a network's needs and requirements as they relate to users, network performance, availability, scalability, integration, and security. Although only one or a few of these needs may constitute driving forces for your project, you should consider each aspect before drafting a project plan. A project based solely on user requirements may result in unforeseen, negative consequences on network performance, if performance needs are not considered as well.

User Requirements

If you have worked as a computer support technician, you know that customers express their needs in a variety of ways. They may regularly call the help desk and ask why they can't access the company's accounting system, they may appeal to their supervisors for access, or they may simply complain to their friends about their unmet need. Each of these methods makes public a need. Unfortunately, none of these methods clearly details the need. To clarify user requirements, you must undertake a more rigorous investigation.

A good technique for beginning to clarify user requirements is user interviews. Just as if you were a reporter, you should ask pointed questions. If the answer is not complete or sufficiently specific, you should follow up your original question with additional questions. The more narrowly focused the answers, the easier it will be to suggest how a project might address those needs. The questions you ask will depend on the type of need involved as well as the user's knowledge and attitude. You may begin your questioning with the following queries:

- What do you need?
- What makes you think this need should be addressed?
- How quickly do you think this need must be addressed?
- Can you suggest at least three ways we can meet this need?
- What kind of priority would you place on this need?
- Are you willing to ignore other needs to have this need met?

Your aim in interviewing users should not be to interrogate them, but rather to guide them to a better articulation of their need. Users often aren't sure about what they want. You can help by drawing out answers and then restating those answers to verify that you have heard and understood them correctly.

During the interview process, be certain not to impose your own opinions on what the user is saying. By doing so, you might miss the point entirely or make the user feel as if you don't truly want to understand his or her needs. Like a reporter, be as objective as you possibly can.

In the process of interviewing users, you may recognize that not all users have the same needs. In fact, the needs of one group of users may conflict with the needs of another group. In such cases, you will have to sort out which needs have a greater priority, which needs were expressed by the majority of users, whether the expressed needs have anything in common, and how to address needs that do not fall into the majority.

After you have interviewed users and collected the results of those interviews, you should be better able to articulate the nature and scope of their needs. The next step is to return to the users (perhaps in a group meeting) and reiterate what you think they were saying. Give users an opportunity to dispute or refine your conclusions. The more time you spend clarifying users' needs, the less time you will have to spend later explaining the project to users and attempting to win their approval for your efforts.

Performance Requirements

Another reason for changing a network may be to improve performance. In an ideal world, the IT department would recognize these impending needs before customers even notice them. For example, if the network administrator is tracking the network's performance and notices that it has been degrading very slightly for the last six months, he may initiate a discussion about how to improve the network performance before users experience noticeable slowdowns.

Although you might think that performance needs are easily quantifiable and therefore easily agreed upon, in fact several engineers and technicians will likely have differing opinions about the nature of the needs and the best tactics for addressing them. Having technical staff answer the following questions will help you identify performance requirements:

- Where do current performance bottlenecks exist? Why do they exist there?
- What kind of performance is optimal?
- Compared with other projects, what priority would you assign to improving performance?
- What measures can bring current performance levels to your recommended level?
- How will performance improvements affect access, availability, customer needs, security, and scalability?
- How will you ensure that measures taken to improve performance are successful?

Take the same approach in interviewing technical staff about performance as you would when interviewing users about their needs: be objective, ask follow-up questions to ensure that you understand the needs they express, and try to guide the staff into defining the needs as specifically as possible. After conducting these interviews, draw conclusions based on the opinions of the majority of participants. Reiterate your conclusions to technical staff to verify that you correctly understood the needs they articulated.

Availability Requirements

Recall from Chapter 14 that "availability" describes how consistently and reliably a file, device, or connection can be accessed by authorized personnel. A number of factors can affect a network's or system's availability, including policies, security, use of redundant components (such as dual power supplies in a critical router), use of redundancy techniques (such as RAID on a server), and connectivity bottlenecks. The need for higher availability may represent the impetus for a network change.

To best determine availability requirements, you should interview both technical and management staff. Technical staff will provide insight about how availability can best be achieved and where the network currently falls short of availability goals. Management staff will provide insight into what types of availability are most important and why.

For example, you may be asked to identify the availability requirements of your organization's new online catalog, which is hosted on a Windows 2000 server in your equipment room. You interview technical staff to determine what type of availability is currently in place and how it might be improved. You also interview management staff to determine how much down time is acceptable, based on their educated guesses regarding how down time will affect sales. If that prediction points to millions of dollars of lost sales for every hour that the server fails, management may be willing to invest hundreds of thousands of dollars to provide entirely redundant server systems to ensure that the online catalog remains continuously available.

Asking the following questions of technical staff will help you clarify their availability requirements:

- Where do current availability flaws or vulnerabilities exist? Where are the network's single points of failure?
- What kind of availability is acceptable (for example, is 99.5% satisfactory, or must the network be available 99.999% of the time)?
- Compared with other projects, what priority would you assign to improving availability?
- What measures can boost current availability to your recommended percentage?
- How will availability improvements affect access, performance, customer needs, security, and scalability?

Asking the following questions of management staff will help you clarify their availability requirements:

- What is the cost of one hour of down time during business hours?
- What is the cost of one hour of down time during off-hours?
- What is your ideal availability percentage?
- What part of the application or access is most important to keep available?

- Compared with other projects, what priority would you assign to improving availability?
- How much are you willing to spend to ensure that the network or system remains available for your ideal percentage of time?

If managers do not have a networking or systems background, they may not realize the costs associated with high availability. Although achieving 99.5% availability may be feasible given their budgetary constraints, increasing the availability to 99.999% may bring exorbitant costs (for example, rather than simply purchasing one switch with dual NICs and dual power supplies, you may need to purchase two identical switches; this component alone could cost more than $50,000). Use your interview as an opportunity to educate members of management, as well as determining their requirements. It's important to emphasize that 100% availability is not possible and that accomplishing 99.999% availability is very expensive.

Integration and Scalability Requirements

With each network change project, you must consider how the proposed change might affect the network's integration and ability to grow and adapt to future changes. In fact, integration and scalability needs may drive network changes, although they are less likely to represent the primary reason for changes than are customer, performance, or security needs.

Because integration and scalability require input from both technical and management staff (perhaps in the form of interviews focused on availability), you should conduct interviews emphasizing these issues with both groups. Asking technical staff to answer the following questions will help you clarify scalability and integration needs:

- How and where is the network's growth currently limited?
- What needs to change to accommodate growth or new hardware/software?
- In what ways (for example, number of users, number of applications, geographical breadth, speed) do you expect the network to grow over the next two years?
- How will improving scalability and integration affect customers, performance, security, and availability?
- How would you prioritize your suggested measures for accommodating growth?

To learn more about scalability and integration needs, you should ask management staff to answer the following questions:

- In what ways do you expect the network (and the organization) to grow over the next one to five years (for example, number of users, number of applications, geographical breadth, speed)?
- Which of these growth directions is your top priority?
- What type of hardware and software do you expect to adopt in coming months and years?

- How much are you willing to spend to optimally position the network and systems for growth?
- Would you place a higher priority on positioning the network and systems for growth or on improving network security, availability, usability, or performance?
- Would you place a higher priority on facilitating better network and systems integration or on improving network security, availability, usability, or performance?

The priorities that technical and management staff place on integration and scalability concerns are particularly important. In most cases, positioning the network for growth and better integration will not be as important to either group as more immediate concerns, such as security (discussed in the following section).

Security Requirements

Some projects result from a need to improve network security rather than an attempt to address user or performance needs. Security needs are typically identified by the technical staff—either network administrators or managers. Examples of projects driven by security needs include installation of firewalls at WAN locations, modifications to firewall or router configurations or operating systems, implementation of intrusion detection systems, or a company-wide effort to enforce security policies, such as good password selection. As you can imagine, the scope and cost of security-related projects can vary dramatically.

No matter what their nature, security needs—like user or performance needs—must be clearly defined before a project commences. Ask management staff how they would prioritize security improvements and how much they would be willing to pay to improve network or systems security. In addition, ask technical staff to answer the following questions to help you identify which needs should be addressed so as to improve your network's security:

- What type of security must be improved (hardware, software, user, facilities)?
- Why does security need to be improved?
- Based on the reasons underlying the need for improved security, to what extent does security need to be improved?
- Will the improvement require extra staff, hardware, software, or consulting services?
- Compared with other needs, what is the priority of security improvements?
- How will security improvements affect network access, performance, or scalability?

As with analyzing user requirements, assessing security requirements may reveal conflicting needs. For example, one faction of network technicians may believe that simply upgrading the version of a server's operating system will address a security flaw, whereas another group of technicians may insist that the security flaw can be resolved only by

installing an expensive firewall upgrade. You may find it helpful to gather technical personnel to debate their points of view and reach a consensus. Alternatively, based on the priority assigned to security improvements, you may conclude that a stronger security measure—such as intrusion detection—is warranted at any cost.

For example, suppose you are the network manager for a growing investment firm that currently uses firewalls at each of its WAN locations and has an effective security policy. Even with these firewalls in place, you may experience an IP spoofing attack that brings down your network. Quantifying the cost of this outage may prove difficult, but you might recognize that you lost potentially hundreds of customers and perhaps millions of dollars in sales. As a result of this breach, you may identify a few critical security needs—for example, the need for better firewall configuration and the need for a mechanism (such as intrusion detection) to stop attacks as they begin. You can assume that if you do nothing, another security breach will occur; the next attack might even be worse (perhaps resulting in stolen or damaged data). Therefore, implementing an expensive intrusion detection system may be well worth its cost.

Using a Pilot Network

As you learned in Chapter 13, one of the best ways to evaluate new technology is to test it in your environment. Similarly, the best way of evaluating a large-scale network or systems implementation is to first test it on a small scale. A small-scale network that stands in for the larger network is sometimes called a **pilot network**. Although a pilot network will be much smaller than the enterprise-wide network, it should be similar enough to closely mimic the larger network's hardware, software, connectivity, unique configurations, and load. If possible, you should establish the pilot network in the same location or environment in which the final network will exist.

The following tips will help you create a more realistic and useful pilot network:

- Include at least one of each type of device (whether a critical router or a client workstation) that might be affected by the change.
- Use the same transmission methods and speeds as employed on your network.
- Try to emulate the number of segments, protocols, and addressing schemes in your network.
- Always implement the same server and client software and configurations on your pilot network as found in your current network.
- Once you have established the pilot network, test it for at least two weeks to verify that its performance, security, availability, or other characteristics meet your criteria.

As the pilot network is intended for testing only, do not connect the pilot network to your live network. By keeping the two networks separate, you will ensure that experimental changes do not inadvertently harm your functioning network.

The pilot network offers you opportunities to both educate yourself and test your implementation goals. Use your time with the pilot network to become familiar with any new features in the hardware or software. Be certain to document what you learn about the new technology's features and idiosyncrasies. As you evaluate your results against your predefined test criteria, note where your results show success or failure. All of this documentation will provide valuable information for your final implementation and for future baselining.

Preparing Users

No matter how small and insignificant your network change appears, if it could potentially affect the way that users accomplish their daily work, you must prepare users for the change. In some cases, the likelihood of a change affecting users will be plainly evident. For example, if you upgrade the version of NetWare used by your file servers and therefore must upgrade the Novell networking client version used by clients, every user will see a slightly different screen when he or she starts up the computer and logs onto the network. If you replace a segment of CAT3 cabling with CAT5 cabling, however, users may never notice the difference.

In almost every instance, you are well advised to notify users of impending changes. That way, if something goes wrong with a change that shouldn't have affected users, creating problems when users try to access the network, these employees will not be caught off guard. For example, you and your staff may install additional RAM in all of your servers over the weekend. Normally, no reason exists to notify users of such an upgrade, assuming it is not performed during business hours. If one of the new memory chips causes problems for a server, however, the change will affect users. In this situation, you might prepare users by announcing that the servers will receive memory upgrades over the weekend and that this change should not cause any changes or problems for client access. Inform users that any type of change represents a possibility for problems to arise, however.

For a major network change, you definitely must inform users. As soon as you have firm details about the nature and timeline of the change, let everyone know about it. Among other things, you should explain to users:

- How their access to the network will be affected
- How their data will be protected during the change. (Even if you are confident that the data will remain unaffected by the change, you should explain how the protection works.)
- Whether you will provide any means for users to access the network during the change
- Whether the change will require users to learn new skills

Although providing all of this information may seem burdensome, it will lessen the possibility that your project might be stymied by negative public reaction. To minimize the amount of time spent communicating with users, you might convene company-wide

meetings or send mass e-mail distributions. If a network implementation has the potential to drastically change the way that users perform their work, you might want to form a committee of user representatives who can attend project meetings and provide input from the users' point of view.

Chapter Summary

- Project management is the practice of managing resources, staff, budget, timelines, and other variables so as to complete a specific goal within given bounds. The person who designs the project plan and oversees the project is the project manager. A project needs not only a plan, but also participants, funding, a specific means of communication, definitive processes, contingency plans, and a testing and evaluation phase.
- A project plan describes how the details of a managed project (for example, the timeline and the significant tasks) are organized. Project plans may take the form of a simple text or spreadsheet document for small projects. Larger projects, however, often require the use of project management software (such as Microsoft Project, PlanView, or PrimaVera Project Planner).
- No matter how large or small the project, its project plan will contain some common elements—tasks and subtasks, timelines, dependencies, resources, and milestones. In addition, project plans may provide information on task priority, flexibility provided in the timeline, task successors, links to other project plans, and so on.
- Every project depends on many resources. The human resources involved in a project may include employees from your department or other departments within the organization, outside consultants, vendor representatives, or employees from other organizations.
- People involved in a project may include project participants, task owners, stakeholders, and sponsors. Stakeholders are people affected by a proposed implementation and the ones to whom the project teams must answer. Sponsors are typically managers or executives who believe in the concept of the project and agree to help obtain support and resources for it.
- Every project, whether it entails a simple hardware upgrade or an entire network redesign, requires funding. A project budget is usually determined as a project begins and approved by a hierarchy of managers whose staff are involved in the project. A project's budget will depend on its breadth and complexity.
- Communications among project participants, stakeholders, and sponsors are critical for several reasons: to ensure that a project's goals are understood by participants, stakeholders, and sponsors; to keep a project's timeline and budget on track; to encourage teamwork among participants; to learn from previous mistakes; to prevent fingerpointing if a task is not completed correctly or on time; to prevent duplication of efforts; and to ensure that stakeholders are prepared for the effects of change.

- Process management involves planning for and handling the steps required to accomplish a goal in a systematic way. The processes you might manage during a project's implementation include change, support, training, transitioning, delegation, and problem resolution.
- For any endeavor that requires the cooperation of several team members, process management is a wise investment of time. Creating a process is not sufficient, however, unless everyone understands the process. You must ensure that the process is communicated to all participants.
- Contingency planning involves identifying steps that will minimize the risk of unforeseen circumstances endangering the quality or timeliness of the project's goals. In other words, it provides a plan for recovering after things go wrong. It's important to spend time planning for contingencies that have a reasonable chance of occurring during the project.
- Once you have reached a project milestone, you will want to verify that you are on the right path. You can accomplish this goal through testing. For testing to be useful, project participants should clearly define the change's purpose before the testing phase commences. To successfully test your implementation, you must establish a testing plan that includes methods and criteria.
- The first decision to make about any proposed project is whether spending the time and resources on this project makes sense—that is, whether it's feasible. To formalize the process of determining whether a proposed project makes sense, you can conduct a feasibility study. A feasibility study outlines the costs and benefits of the project and attempts to predict whether it will produce a favorable outcome (for example, whether it will achieve its goals without imposing excessive cost or time requirements on the organization).
- Once a project is deemed feasible, you and the project team should define the project's goals. One technique for setting project goals is to begin with a broad goal, then create narrower, more specific goals that will contribute to the larger goal.
- In addition to being specific, project goals should be attainable. If project goals are not feasible from the outset, you risk losing backing from both project sponsors and participants. If you lose their support, the project will most likely fail.
- Baselining includes keeping a history of network performance, the physical topology, logical topology, number of devices on the network, operating systems and protocols in use, and number and type of applications in use. In other words, it provides a complete picture of the network's current state. Baselining is critical to network implementations because it provides the basis not only for determining what types of changes might improve the network, but also for later evaluating how successful the improvements were.
- If you have not already collected and centrally stored baseline information, it may take the work of several people and several weeks to compile it, depending on the size and complexity of your network. This evaluation will involve visits to the

telecommunications and equipment rooms, an examination of servers and desktops, a review of receipts for software and hardware purchases, and potentially the use of a sniffer or network monitoring software package.

- Needs assessment is the process of clarifying the reasons and objectives for proposed change. It involves interviewing users and other stakeholders and comparing their perceptions to factual data. In addition, it may involve analyzing network baseline data. Your goal in performing a needs assessment is to decide whether the change is worthwhile and necessary and to determine the appropriate scope and nature of the change.
- A good technique for beginning to clarify user requirements involves user interviews. Just as if you were a reporter, you should ask pointed questions. The more specific the answers provided, the easier it will be to suggest how a project might address those needs. Users often are unsure about what they want. You can help by drawing out answers and then restating those responses to verify that you have heard and understood the users correctly.
- In the process of interviewing users, you may recognize that not all share the same needs. In fact, the needs of one group of users may conflict with the needs of another group. In such cases, you must sort out which needs have a higher priority, which needs were expressed by the majority of users, whether the expressed needs have any common suggestions, and how to address needs that do not fall into the majority.
- Although you might think that performance needs are easily quantifiable and therefore readily agreed upon, several engineers and technicians will more likely have differing opinions about the nature of the needs and ways to satisfy them. Have technical staff answer a number of questions to clarify performance requirements.
- To best determine availability requirements, you should interview both technical and management staff. Technical staff will provide insight about how availability can best be accomplished and where the network currently falls short of availability goals. Management staff will provide insight into what types of availability are most important and why.
- If managers do not have a networking or systems background, they may not realize the costs associated with high availability. Although achieving 99.5% availability may be feasible given their budgetary constraints, increasing the availability to 99.999% may bring exorbitant costs. Use your interview as an opportunity to educate managers, as well as to determine their requirements.
- Integration and scalability needs may drive network changes, although they are less likely to be the primary reason for changes than are customer, performance, or security needs. Asking both technical and management staff to outline their priorities is particularly important in assessing integration and scalability needs. In most cases, positioning the network for growth and better integration will not be as important to either group as satisfying other requirements.

- Some projects result from a need to improve network security rather than addressing user or performance needs. Security needs are typically identified by the technical staff—either network administrators or managers.
- Like user or performance needs, security needs must be clearly defined before a project commences. Ask management staff how they would prioritize security improvements and how much they would be willing to pay to improve network or system security. In addition, have technical staff answer a number of questions about how best to improve security.
- The best way of evaluating a large-scale network or systems implementation is to first test it on a small scale. A small-scale network that stands in for the larger network is sometimes called a pilot network. Although a pilot network will differ from the enterprise-wide network, it should mimic it closely enough to represent the larger network's hardware, software, connectivity, unique configurations, and load.
- In almost every instance, it is advisable to notify users of changes. You should share at least the following information: how users' access to the network will be affected; for how long their access to the network will be affected; how their data will be protected during the change; whether you will provide any means for users to access the network during the change; and whether the change will require them to learn new skills.

Key Terms

contingency planning — The process of identifying steps that will minimize the risk of unforeseen circumstances endangering the quality or timeliness of the project's goals.

feasibility study — A study that determines the costs and benefits of a project and attempts to predict whether the project will result in a favorable outcome (for example, whether it will achieve its goal without imposing excessive cost or time burdens on the organization).

Gantt chart — A popular method of depicting when projects begin and end along a horizontal timeline.

milestone — A reference point that marks the completion of a major task or group of tasks in a project and contributes to measuring the project's progress.

needs assessment — The process of clarifying the reasons and objectives for a proposed change so as to determine whether the change is worthwhile and necessary and to elucidate the scope and nature of the proposed change.

owner — The person who takes responsibility for ensuring that project tasks are completed on time and within budgetary guidelines.

pilot network — A small-scale network that stands in for the larger network. A pilot network may be used to evaluate the effects of network changes or additions.

predecessors — Tasks in a project that must be completed before other tasks can begin.

process management — Planning for and handling the steps involved in accomplishing a goal in a systematic way. Processes that might be managed during a project's implementation include change, support, training, transitioning, delegation, and problem resolution.

project management — The practice of managing resources, staff, budget, timelines, and other variables so as to complete a specific goal within given bounds.

project plan — The way in which details of a managed project (for example, the timeline and the significant tasks) are organized. Some project plans are created via special project planning software, such as Microsoft Project.

resources — In project management, a term used to refer to staffing, materials, and money.

sponsors — People in positions of authority who support a project and who can lobby for budget increases necessary to complete the project, appeal to a group of managers to extend a project's deadline, assist with negotiating vendor contracts, and so on.

stakeholder — Any person who may be affected by a project, for better or for worse. A stakeholder may be a project participant, user, manager, or vendor.

Review Questions

1. What type of chart is used in project management to express how tasks will occur over a horizontal timeline?
   a. Pert
   b. Gantt
   c. Stuelt
   d. Ager
2. What do you call a task that must be completed before another task can begin?
   a. decessor
   b. successor
   c. predecessor
   d. subsessor

3. What is the purpose of a milestone?
   a. to mark the beginning of a major task
   b. to mark the completion of a subtask within a major task
   c. to mark the completion of a major task or group of tasks
   d. to mark the completion of the project
4. Who would be a likely sponsor for a network backbone upgrade?
   a. help desk technician
   b. network technician
   c. Vice President of Operations
   d. IT director
5. In a project to upgrade the version of Microsoft Exchange on the network, a receptionist who uses Exchange is an example of a project stakeholder. True or False?
6. In what type of situation might additional funding have no effect on an enterprise's ability to complete a project more quickly?
   a. when the project depends on a limited number of highly specialized staff members
   b. when the IT department's budget is fixed
   c. when customers' needs aren't clearly defined
   d. when resource costs exceed the initial estimate
7. Name four benefits of effective communication among project participants.
8. What type of process can be managed to improve the efficiency of how modifications to a project plan are handled?
   a. problem
   b. change
   c. support
   d. training
9. Which predefined process can help you recover when a project suffers a setback?
   a. contingency planning
   b. transition planning
   c. budget reevaluation
   d. feasibility study
10. Which of the following implementation steps should come first?
    a. find vendors for necessary hardware additions
    b. determine the feasibility of the proposed project
    c. evaluate how users' needs might conflict
    d. identify the need for a project

11. Which step in the implementation of network projects should precede the final release of changes to all users?
    a. update the documentation to reflect changes on the network
    b. reinstall client software on older workstations
    c. release the change to a group of test users who will evaluate it
    d. suggest ways to improve the network's availability after the change
12. What is the last step in a network implementation project?
13. Why is it sometimes advisable to hire external consultants to perform a feasibility study?
14. Which of the following is a good example of test criteria that can be used to evaluate the success of a network backbone upgrade?
    a. Did the change improve network performance?
    b. Are 50% of the customers more satisfied with the network's performance?
    c. As a result of the change, are customers receiving e-mail more quickly?
    d. Did the change result in a 30% reduction in the time that it takes for data to travel from the router in building A to the router in building B?
15. Baselining will help you determine how long a project should take. True or False?
16. What can you do if your needs assessment interviews indicate that two groups of customers have conflicting needs?
    a. reinterview customers with the aim of reaching consensus
    b. gather customers with conflicting views in one room and ask them to debate the merits of their positions
    c. determine the costs of addressing each conflicting need and make a decision based on the lowest-cost solution
    d. compile the results of your interviews and determine which needs are better justified and expressed by the majority of users
17. Why does it cost significantly more to achieve 99.999% availability than it does to achieve 99.5% availability?
18. Which of the following questions should you ask your organization's management staff so as to better determine scalability needs?
    a. How much are you willing to spend to optimally position the network and systems for growth?
    b. Where is the network currently inhibited from accommodating new devices?
    c. In what ways can the WAN be expanded to integrate new locations easily?
    d. How will increasing the network's capacity for growth affect its performance?

19. Give two examples of projects that might be driven by security concerns.
20. If you were planning to replace all 25 routers in your enterprise-wide network with switches, what kind of pilot network might you design to test whether the switches will work as planned?

HANDS-ON PROJECTS

Project 16-1

To familiarize yourself with project management, you should take some time to experiment with project management software. This exercise introduces you to the most popular project management package, Microsoft Project 2000. You will use Microsoft Project to demonstrate the creation of a project plan. You will identify tasks, subtasks, timelines, and resources for a sample networking project. For this exercise, you will need a computer with Microsoft Project 2000 installed.

1. To launch Microsoft Project, click **Start**, point to **Programs**, then click **Microsoft Project**.
2. Unless you have disabled it, the Microsoft Project Help - Welcome! window opens on the right side of your screen. Close this window to begin adding tasks to the project plan.
3. The main Microsoft Project window expands, with a frame for task listings on the left side of the screen and a blank timeline on the right side of the screen. Click and drag the vertical bar that separates the task list from the timeline to the right so that you can view all columns to the right of the task list. By default, you should see the columns Task Name, Duration, Start, Finish, Predecessors, and Resource Names, as shown in Figure 16-3.
4. Click on the first row of the Task Name column. To add the first task, type **Upgrade Network.**

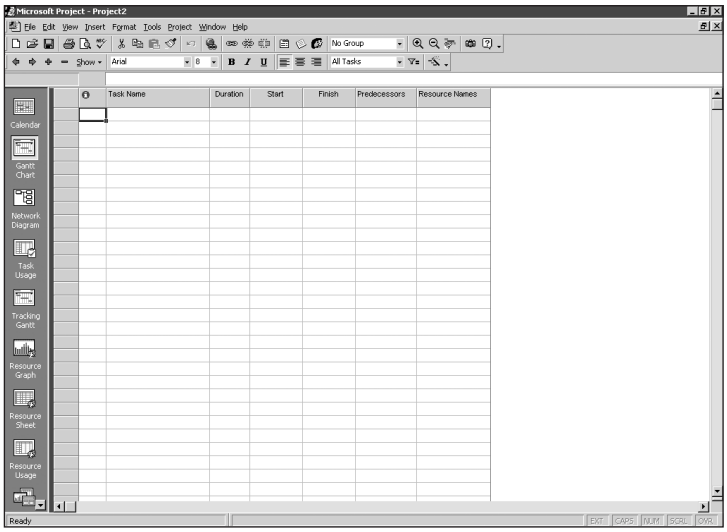


Figure 16-3 Default columns in Microsoft Project

5. Now you will enter some subtasks that make up the larger task you just created. Insert the following tasks in the five rows below the first task: **Perform Network Baseline**, **Assess Users' Needs**, **Purchase Hardware and Software**, **Implement Pilot Network**, **Implement Backbone Changes**.
6. To identify these five tasks as subtasks belonging to the "Upgrade Network" task, select and highlight each of them (by clicking on the task name), then click the right arrow button on the formatting toolbar to indent the task. Notice that the "Upgrade Network" task becomes bolded.
7. Click the Duration cell next to the task name "Perform Network Baseline," then enter a duration of **10** (days).
8. Enter durations for the remaining four subtasks, based on how long you guess they might take. As you add these durations, the duration for the "Upgrade Network" task changes to reflect the length of its subtasks' durations.
9. By default, the project's Start date for the subtasks will be set to today's date. Change the Start date for "Perform Network Baseline" to a date two weeks from now. Notice that the Finish date changes, based on the durations that you entered in Steps 7 and 8.
10. In the Predecessors column for "Purchase Hardware and Software," enter **2** to indicate that this task is dependent on the second task, "Perform Network Baseline." What happens to this task's Start and Finish dates? Why?
11. Change the Start date for "Assess Users' Needs" to tomorrow's date.

12. Now you can insert predecessors for the remaining tasks. Make "Purchase Hardware and Software" also dependent on task 3 (in addition to task 2), "Implement Pilot Network" dependent on task 4, and "Implement Backbone Changes" dependent on task 5.
13. To save the project plan you have created, click **File** on the main menu, and then click Save. The Save As dialog box appears. In the File name text box, type **rollout**. Click **Save** to save the project plan.
14. The Planning Wizard dialog box appears, asking whether you want to save your project plan with a baseline. Click **OK** to save the project plan without a baseline (the default selection).
15. Click **File** on the main menu, and then click **Exit**. Microsoft Project closes.

Now you have created the skeletal beginnings of a project plan, with start and finish dates and predecessors. In the following exercises, you will expand on this simple plan.

Project 16-2

Earlier in this chapter, you were introduced to the concept of a Gantt chart, which offers a way to depict project timelines. In this exercise, you will view and modify a Gantt chart that is based on the simple project plan that you created in Project 16-1. For this project, you will require the computer with Microsoft Project 2000 installed that you used in the previous project.

1. View the project plan that you began in Hands-on Project 16-1.
2. Click **Format** on the menu bar, then click **GanttChartWizard**. The GanttChartWizard - Step 1 dialog box appears.
3. Click **Next** to continue.
4. The GanttChartWizard - Step 2 dialog box opens, prompting you to identify the kind of information you want to include in your Gantt chart. The default selection is **Standard**. Keep this selection, and click **Next** to continue.
5. The GanttChartWizard - Step 9 dialog box opens. (Because you accepted the standard settings in the previous step, the wizard skipped from Step 2 to Step 9.) Here you can identify what kind of task information should appear in your Gantt chart. Select **Dates**, then click **Next** to continue.
6. The GanttChartWizard - Step 13 dialog box opens. (Again, based on your selection in the previous step, the wizard skips ahead to Step 13.) Here you can specify whether the chart should show link lines between dependent tasks. Keep the default selection of **Yes, please**, then click **Next** to continue.
7. The GanttChartWizard - Step 14 dialog box opens, announcing that the wizard is ready to format your Gantt chart. Click **Format It** to continue.
8. Click **Exit Wizard** to close the wizard and return to the project plan.

9. To view the Gantt chart, click and drag the vertical bar that separates your task list from the timeline all the way to the left. The Gantt chart will appear in the center of the screen. Use the scroll bar at the bottom of the screen to view the entire chart.
10. Click File on the main menu, and then click **Exit**. Microsoft Project closes.

Project 16-3

In this project, you will elaborate on the plan that you began in Project 16-1 by assigning resources and adding milestones. This exercise requires the same computer and Microsoft Project file that you used in the two previous exercises.

1. Drag the vertical separator bar to the right to hide the Gantt chart and reveal the list of tasks on the left side of the Microsoft Project screen.
2. Click on the Resource Names cell for the "Perform Network Baseline" task. Enter **RG, BT** to indicate that Reggie Gibson and Brett Turrel will handle this task.
3. Assign resources to the remaining subtasks. In the Resource Names cell for "Assess Users' Needs," enter **KR, SN**. In the Resource Names cell for "Purchase Hardware and Software," enter **SS**. In the Resource Names cell for "Implement Pilot Network," enter **RG, BT, MM, MG**. In the Resource Names cell for "Implement Backbone Changes," enter **BT, MM, SS, AV**.
4. As the task of implementing a pilot network is a significant part of the project, its completion should mark a milestone. To identify this task as a milestone, double-click the task name. The Task Information dialog box appears. The General tab is selected by default, as shown in Figure 16-4.

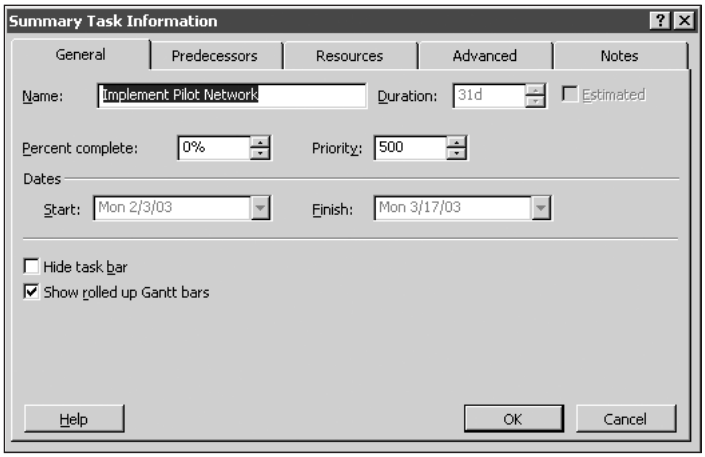


Figure 16-4 Summary Task Information dialog box

5. Click the **Advanced** tab to view additional information about the task. On that tab, check the box next to **Mark task as milestone**.
6. Click **OK** to save your changes.
7. Drag the vertical separator bar to the left and notice how the task appears now (as a milestone).
8. Click **File** on the main menu, and then click **Exit**. Click **Yes** to save the changes you have made to your project plan. Microsoft Project closes.

CASE PROJECTS

1. Your colleagues in the IT department are considering migrating your organization's network from 4-Mbps Token Ring to 100-Mbps Ethernet. They posit that the change will provide users with better performance and position your network for easier growth in the future. Your organization's network consists of the following items:
   - 5 file- and print-sharing servers running Novell NetWare 5.0
   - 1 backup server
   - 1 Internet gateway and mail server
   - 350 users in two buildings located across the street from each other and connected via a T1 link

   Each user in your organization depends on the network for e-mail, file storage, printing, and office applications (including word-processing, spreadsheet, and database programs).

   The IT Director has asked you to list the ways in which this change could improve network performance. In addition, list ways that this change could affect users, support, maintenance, profitability, scalability, integration, and security.
2. Your company's project to migrate from Token Ring to Ethernet has been deemed feasible by an independent consultant. As this change represents a major network overhaul, the IT Director decides it might also be time to make smaller changes to accommodate users' needs. He assigns you the task of determining the needs of the 350 users. Draft a questionnaire that you will follow during your user interviews. When writing the questionnaire, consider how you will measure and tally the responses and what you might do if users' needs conflict with one another.
3. As a result of your thorough user needs assessment, the IT management staff has decided that, although the migration from Token Ring to Ethernet is important, a more pressing need is to upgrade the version of the NetWare client on each desktop. The IT Director assigns you to manage the project. Draft a project plan outline that will serve as a roadmap for accomplishing this wholesale client upgrade. Include estimated timelines, dependencies, and milestones.

4. Because the company-wide client upgrade will change the way that every user accesses the network, you want to apprise every user of the change and explain how it might affect him or her. Write a memo to users that communicates this information.
5. While you are conducting the client upgrades across the network, one of your colleagues is planning for the larger project of changing the network from Token Ring to Ethernet. She asks your help in setting up a test lab to use for the pilot network. List every item that should be in the test lab so as to adequately test the change plan.